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PROCEDURE FOR CHECKING TEMPERATURE OF QUICK-FROZEN FOODS

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PROCEDURE FOR CHECKING TEMPERATURE OF QUICK-FROZEN FOODS

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*Shri John P. George was Convener of the Subcommittee at the time of the meeting in which this standard was considered for finalization.

Indian Standard

PROCEDURE FOR CHECKING TEMPERATURE OF QUICK-FROZEN FOODS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 31 May 1976, after the draft finalized by the Fish and Fisheries Products Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 Temperature of quick-frozen foods is often required to be checked for proper processing and storage. This standard has been drawn up to prescribe internationally recognized procedure of checking temperature for uniform presentation and interpretation of data.

0.3 This standard is mainly based on the draft codex standard on the subject prepared by the Codex Alimentarius Group of Experts on the Standardization of Quick-Frozen Foods.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard outlines procedure for measuring temperature of quick-frozen foods.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Temperature — The temperature measured at the point of placement of the sensitive part of the sensing element.

3. TEMPERATURE INDICATING AND RECORDING INSTRUMENTS

3.1 Instruments that meet the following requirements should be used for control purposes.

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*Rules for rounding off numerical values (*revised*).

3.1.1 The half-value period should not exceed 0·5 minute.

3.1.2 The instrument should be accurate to within ±0·5°C over the range −30° to +30°C.

3.1.3 It should be sensitive to changes of 0·5°C.

3.1.4 The accuracy of the measurement should not be affected by the temperature of the surroundings.

3.1.5 Markings on the scale should be in divisions of 1°C.

3.1.6 For measuring instruments other than glass-stem thermometers, a setting device to allow adjustment of the indicating needle during recalibration should be provided.

3.1.7 The sensitive part of the measuring device should be so constructed as to ensure good contact with the quick-frozen food products.

3.1.8 Electrical instrument should be protected from undesirable influences resulting from condensation of moisture.

4. METHOD I — MEASURING TEMPERATURE IN THE PRODUCT (REFERENCE METHOD)

4.1 Reliable information on the temperature of the food products should be obtained only by measuring the temperature in the product. The product temperature should be measured at any point in the product which is 25 mm below the surface. In the case of packages with one dimension less than 50 mm, the measurement point should be half-way through this dimension. It is preferable to reach this point by inserting the sensing element so that as much of it as practicable is in the product.

4.2 Instruments for Measuring Temperature

4.2.1 *Glass-Stem Thermometer* — The glass-stem thermometer should have the following characteristics:

a) An overall length of about 250 mm,
b) A sharp-pointed round stem,
c) A pocket carrying case to protect the thermometer, and
d) Alcohol filling is preferred to mercury.

NOTE — Glass-stem thermometers should be used with great care in proximity of food.

4.2.2 *Metal-Dial Thermometer* — The metal-dial thermometer should have the following characteristics:

a) An overall length of about 150 mm,
b) A sharp-pointed stainless steel stem,

c) A pocket carrying case to protect the thermometer, and
d) A dial hermetically sealed with plastic and not with glass.

Note — Instrument may be based on the principle of liquid expansion, vapour pressure change, spring deformation or metal expansion.

4.2.3 *Electrical Thermometer (Electrical Resistance or Thermocouple as the Sensing Element)* — The sensing element of the electrical thermometer should have the following characteristics:

a) An overall length of about 150 mm;
b) A sharp-pointed stainless steel sensitive part; and
c) Leads of known resistance, preferably leads with built-in compensation resistance.

4.2.4 *Electrical Temperature Recording Instruments* — These instruments are in principle built on to the equipment described in **4.2.3**. These instruments should be able to record temperatures on suitable charts over a determined period of time.

4.2.5 *Instruments for Making Holes in the Product* — A sharp-pointed metal instrument, such as an ice-pick or hand drill which may easily be cleaned, should be used. The hole in the packet and product should be only marginally larger in diameter than the sensitive part of the sensing element to be used.

4.3 Procedure

4.3.1 *Making a Hole* — Sensing elements are generally not strong enough to penetrate into blocks of frozen foods. A hole should be made in the packages concerned using a probe or hand drill as specified in **4.2.5**. The hole should be 50 mm deep.

4.3.2 *Pre-cooling*

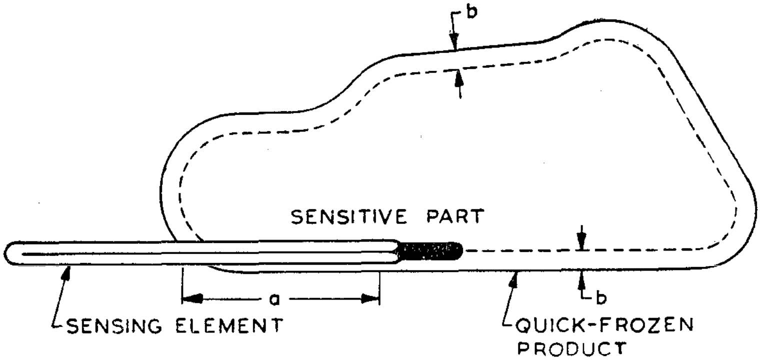
4.3.2.1 A package should be selected at random from the load for use in pre-cooling the probe or hand drill and the sensing element. This will be referred to hereafter as the pre-cool package. A warm probe, hand drill or sensing element should not be placed in the test package.

4.3.2.2 The sensing element should be inserted into the centre of the pre-cool package and it should be left there for at least 2 minutes. It should not be removed from the pre-cool package until it can be inserted in the test package.

4.3.2.3 Pre-cooling may also be carried out between packages or just by allowing the equipment to stand in cold air of about the same temperature.

4.3.3 *Temperature Reading* — The sensing element should be removed from the pre-cool package and immediately inserted into the test package at a depth as indicated in **4.1**. The temperature should be read when this has reached a steady value or should be recorded continuously according to the instrument used.

4.3.4 The method of measuring product temperature is illustrated in Fig. 1.



a = 25 mm or longer
b = 25 mm

FIG. 1 METHOD OF MEASURING PRODUCT TEMPERATURE

5. METHOD II — MEASURING SURFACE TEMPERATURE OF THE PRODUCT (PRACTICAL METHOD)

5.1 A reasonable approximation as to the temperature of the product may be obtained by measuring the temperature at the surface of the product. The surface temperature of the product may be obtained in a non-destructive way and is sufficiently accurate for routine temperature checks, provided good contact is achieved by the sensing element between the packages or cases. By applying adequate pressure, the readings should, generally, be within ±1°C of the product temperature. The sensitive part of the sensing element should be inserted at least 50 mm between the packages or cases.

5.2 Instruments for Measuring Surface Temperature of the Product

5.2.1 *Glass-Stem Thermometer* — The glass-stem thermometer should have an elliptical diameter not more than 5 mm thick such as to ensure as little air leakage between the packages as possible, in addition to those given in **4.2.1**.

5.2.2 *Metal-Dial Thermometer* — The metal-dial thermometer should have a flat stainless steel stem not more than 5 mm thick instead of the sharp-pointed round stem as given in **4.2.2**.

5.2.3 *Electrical Thermometer (Electrical Resistance or Thermocouple as the Sensing Element)* — The sensing element of the electrical thermometer should have the same characteristics as given in **4.2.3**.

5.2.4 *Electrical Temperature Recording Instruments* — These instruments are in principle built on to the equipment described in **4.2.3**. These instruments should be able to record temperature on suitable charts over a determined period of time.

5.3 Procedure — This method is especially applicable to measuring temperature in full loads and master packages and is, therefore, applicable only in cold stores during loading and unloading and during transportation.

5.3.1 *Selection of Cases* — Seven packages or cases of frozen foods should be selected from the lot in question. Any 3 of the 7 packages should be stacked on the floor area of the natural cold environment for the lot being sampled. A side wall of top case (number of stack) should be cut at either end with a sharp knife as shown in Fig. 2.

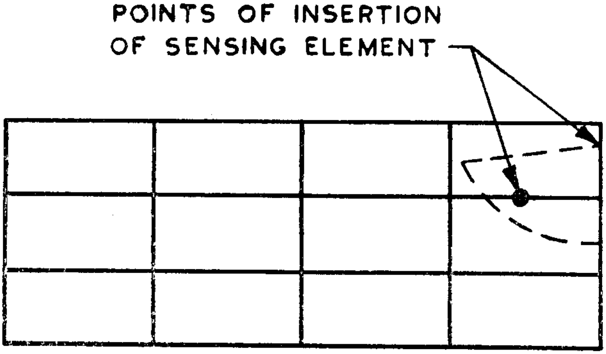


Fig. 2 Method of Measuring Surface Temperature of a Product

5.3.2 *Temperature Reading* — The cut tab should be bent outward. The sensing element should be inserted at about the centre of the first stack of packages and between the first and second layers of packages so that all of the sensing element is in firm contact with package walls. The other 4 cases should be stacked on top of the case containing the sensing element. The temperature should be read when this has reached a steady value or should be recorded continuously according to the instrument used. The cut side wall area of the case should be closed and taped after use.

5.3.3 The method of measuring surface temperature of the product is illustrated in Fig. 2.

6. METHOD III—MEASURING TEMPERATURE OF THE AIR SURROUNDING THE PRODUCT

6.1 A rough approximation of the temperature of the product may be obtained by measuring the temperature of the surrounding air. The temperature of the air surrounding a product may be measured under practical conditions during storage, transport and distribution (including retail cabinet). The temperature of the air surrounding a quick-frozen product does not necessarily represent the temperature of the product. Depending on conditions, the temperature of the surrounding air may be higher or lower than that of the product. Under certain conditions, air temperature may provide a good approximation as to the product temperature. These conditions are as follows:

a) A stabilized temperature in the loading space,

b) No air currents,

c) A relatively slow response rate of the instrument, and

d) Measurements made over at least 30 minutes show no noticeable fluctuation.

Such conditions generally prevail only in a storage room and between the frozen products covered with a master pack.

6.2 Instruments for Measuring Temperature of the Air Surrounding the Product

6.2.1 The instruments described in **4.2.1** to **4.2.4** may be used subject to the conditions set out under **6.1**.

6.2.2 Mechanical temperature recording instruments may also be used. These instruments consist of a self-contained unit, the sensitive element is generally directly connected to the recording part and adequately protected during handling. Instruments of this sort may be placed in cases of the product, replacing some of the packs in the case and to give readings of the air temperature. These instruments should be pre-cooled before insertion into the case. They provide a relatively uncomplicated method of measuring temperature surrounding the product at a certain spot over a period of time.

6.3 Procedure

6.3.1 *Positioning the Sensitive Element* — The sensitive element should be surrounded by the quick-frozen product and protected from direct colder or warmer air currents.

6.3.2 *Recording Instruments* — appropriate to this sort of measurement may be placed in cases of the product replacing some of the packs.

6.3.3 *Temperature Reading* — The temperature fluctuations should be read over a period of 10 to 30 minutes, depending on the degree of fluctuation.

7. CALIBRATION OF THERMOMETERS

7.1 Thermometers should be checked at regular intervals depending on how consistent they are for accuracy. Instruments handled from one load to another should be checked weekly. Instruments used during transport should be checked before a new load is to be carried.

7.2 The test may be made by immersing the thermometer sensing element in an ice water-bath. A one-litre container (vacuum flask) should be filled with chipped ice and then filled entirely with cold water. It should be stirred for at least 2 minutes before the sensing element is inserted into the centre of the mixture. The sensing element should be allowed to touch the container. The temperature indicated by the thermometer should be observed after passing for at least 2 minutes to allow stabilization to take place. The immersed thermometer should read within ±0·5°C of 0°C. The 0°C point on the scale should emerge just above the top of the flask. All other elements should be entirely in the ice.

7.3 For checking the thermometer at temperatures in the range of −18° to −21°C, a brine mixture consisting of 1 part by mass of sodium chloride and 3 parts by mass of chipped ice should be used. The reading of the thermometer under test should be compared with a reference thermometer.

7.4 Both temperature sensors should be inserted into the brine mixture with the stems next to each other, taking care that they should not touch the container. The temperatures indicated by the thermometers should be observed after at least 2 minutes to allow stabilization to take place. Thermometers may also be checked by comparing the reading from the thermometer under test with the reference thermometer when both are held along-side each other in the same ambient. If no reference thermometer is available, an eutectic mixture of analytical grade sodium chloride and ice, intimately mixed, gives a temperature of −21·4°C.

7.5 If an error is indicated greater than 0·5°C, then the indication of the thermometer should be corrected by means of its standard adjustment mechanism. After adjustment, the indication of the thermometer should be re-checked.

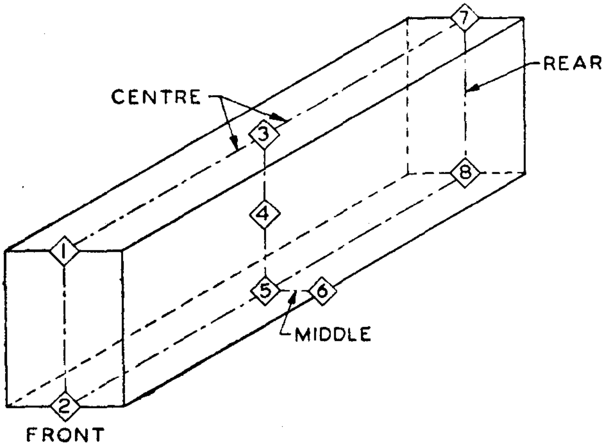
8. FULL SAMPLING

8.1 Selection of Test Packages — The selection of location from which to take test packages for temperature measurement is difficult to specify precisely and should be a matter of judgement, taking account of any previous history of the load or lot being examined and also the results obtained as the sampling proceeds. The correct interpretation of the results depends, to a very large extent, on informed sampling. The test packages should be selected in such a way that their temperatures should be representative, but for commercial reasons, the minimum number of checks should be made to give temperatures representative of the stock being examined.

8.2 Sampling in Various Locations

8.2.1 *Cold Stores* — If cases are stacked closely together, that is, on a pallet, then temperature readings should be taken from a package on an outer face of an outer case, and from a package from a case in the centre of the lot. These temperatures are known as ‘ outer temperatures ’ and ‘ centre temperatures ’. If individual cases are being examined, then a pack should be selected from at least one layer in the middle and other from the outside of the case. A significant difference between the two readings will indicate a temperature gradient in the pallet load and may lead to taking more temperatures if the previous history of the pallet load suggests that elevated temperatures recorded have been sustained for a sufficient period of time to cause significant quality loss.

8.2.2 *Vehicles or Transport Container Unit* — When unloading packages should be selected for temperature measurement from the locations shown in Fig. 3. These packages normally will give product temperatures representative of the load. Any additional locations judged to be useful may be tested taking into account the sensitivity of the product to thermal shock, knowledge of the duration of the journey, etc.



1. Top front, centre
2. Bottom front, centre
3. Top middle, centre
4. Half-way up middle, centre
5. Bottom middle, centre
6. Bottom middle, side (next to door if there is a side door)
7. Top rear, centre
8. Bottom rear, centre

Fig. 3 Suggested Locations in a Car or Truck from Which Test Packages Should be Selected

8.2.3 *Retail Display Cabinets*

8.2.3.1 *Bin cabinets* — A product in the top layer of the cabinet should be selected and its temperature measured. The cabinet should be checked that it is not on defrost or recovering from a defrost cycle and it should be noted if the indicated product temperature is within the permissible range. If the indicated temperature is outside the permissible range, then the temperature at the centre and base of the cabinet should be taken before acting on the first result.

8.2.3.2 *Vertical cabinets* — In addition, the temperature of products on the front of shelves at the right- and left-hand sides of the cabinet should be taken. The indicated readings should be within the permissible limits.

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